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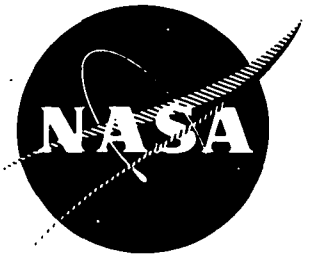

BIBLIOGRAPHY OF INFORMATION ON MECHANICS OF STRUCTURAL FAILURE

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16. Abstract

This Bibliography is comprised of approximately 1500 reference citations related to six problem areas in the mechanics of failure in aerospace structures. The bibliography represents a search of the literature published in the ten year period 1962-1972 and is largely limited to documents published in the United States.

Listings are subdivided into the six problem areas: (1) Life prediction of structural materials; (2) Fracture toughness data; (3) Fracture mechanics analysis; (4) Hydrogen embrittlement; (5) Protective coatings; and (6) Composite materials. An author index is included.

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FOREWORD

This Bibliography is comprised of approximately 1500 reference citations related to the six problem areas in the mechanics of structural failure defined in the Introduction. The literature search which resulted in the bibliography was conducted as a part of NASA Lewis Research Center Contract NAS 3-16681.

The purpose of this publication is to provide, in easy reference form, a survey of the literature published in the ten year period 1962-1972 regarding failure modes and mechanisms of aerospace structures. Documents referenced that are dated earlier than this period have been included because of the frequency of their citation, usually because they are regarded as "classics". It therefore provides a basis for broadening the information based produced for the Aerospace Safety Research and Data Institute.

It is recognized that the bibliography is an incomplete listing and represents only an initial installment. Nevertheless, it is hoped that it will contribute as a guide to those who seek related information.

TABLE OF CONTENTS

INTRODUCTION

The Bibliography of Information on the Mechanics of Structural Failure contains references pertaining to the six problem areas listed below:

I. **Life prediction of materials at high temperatures and exposed to monotonic and cyclic loading** – Includes information on low cycle and thermal fatigue particularly as it applies to turbine buckets in the gas turbine engine and high cycle fatigue data for materials used in components such as engine bearings.

II. **Fracture toughness data on various structural materials** – Available data are categorized with respect to test methods, K_{Ic} versus K_c, and other peculiar parameters considered by the investigators. In particular, data derived from ASTM standard tests are identified.

III. **Fracture mechanics analyses – capabilities and limitations** – A significant amount of publications deal with linear eleastic fracture mechanics which assumes plane strain. Attempts were made to identify any work that was done, taking into account elastic-plastic theories.

IV. **Hydrogen embrittlement of superalloys** – This subject is of interest regarding turbine buckets, which are exposed to high temperatures. It will be of increasing importance if additional interest develops in using hydrogen as the fuel in gas turbine engines.

V. **Protective coatings** – Airbreathing engines operating in contaminated environments are in need of protection against attach by the contaminants. Information on the various candidate coatings and the effects of combustion products of contaminants in jet fuels on engine components is of prime interest. For example, the sulfur ordinarily contained in JP fuels reacts with salt present in shipboard and offshore environments and the resulting compounds attack turbine buckets severely.

VI. **Composite materials data on low cycle and thermal fatigue** – Our aim here is to search for data related to composite structural materials.

This Bibliography is divided into seven parts. Parts I - VI are comprised of citations in the six problem areas researched. All references are listed alphabetically, using the surname of the principal author. Part VII is a complete author index, including the names of co-authors.

Each entry includes the author or corporate source, the title, a publication source, and the date. The format used is unique to the purpose of the bibliography. All entries preceded by an asterisk (*) are included in the Aerospace Safety Research and Data Institute data base, i.e., ASRDI Forms 102A were completed for them. The remaining citations are either references cited by authors whose work has been abstracted or are valid references that could not be researched under the current contract because of funding limitations. When it could be readily established, the entry has been qualified to show its availability from one or more of the several government or government-sponsored information distribution centers.

Alternative sources for the references in the bibliography are identified as follows:

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The order of precedence for information included in the citations in this bibliography is:

1. Author(s)
2. Title
3. Original source, i.e., technical report number or proceedings, journals, etc.
4. Date of publication
5. Alternative source

A particular effort has been made to highlight the date of publication because of its relevance in a field of research that is continually changing.

In general, the source for all references is an activity in the United States of America. It is recognized that considerable Russian and Japanese literature exists in Problem Areas I and VI and that only a fragment of it is referenced because of the problem of translation. Similarly, time did not permit an adequate survey of literature published in the United Kingdom, Australia, and several European nations relating to Problem Areas I, II, III and VI.

Classified documents have been omitted. It is recognized that some useful data in Problem Areas I and VI exists in classified publications.

PROBLEM AREA 1

Life prediction of materials at high temperatures and exposed to monotonic and cyclic loading – Includes information on low cycle and thermal fatigue particularly as it applies to turbine buckets in the gas turbine engine and high cycle fatigue data for materials used in components such as engine bearings.

LIFE PREDICTION OF STRUCTURAL MATERIALS

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PROBLEM AREA 2

Fracture toughness data on various structural materials – Available data are categorized with respect to test methods, K_{Ic} vs K_c and other peculiar parameters considered by the investigators. In particular, data derived from ASTM standard tests are identified.

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PROBLEM AREA 3

Fracture mechanics analysis — capabilities and limitations — A significant amount of publications deal with linear elastic fracture mechanics and assumes plane strain. Attempts are made to identify any work that was done, taking into account elastic-plastic theories.

FRACTURE MECHANICS ANALYSIS

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PROBLEM AREA 4

Hydrogen embrittlement of superalloys — This subject is of interest regarding turbine buckets, which are exposed to high temperatures. It will be of increasing importance if additional interest develops in using hydrogen as the fuel in gas turbine engines.

HYDROGEN EMBRITTLEMENT

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PROBLEM AREA 5

Protective coatings – Airbreathing engines operating in contaminated environments are in need of protection against attack by the contaminants. Information on the various candidate coatings and the effects of combustion products of contaminants in jet fuels on engine components is of prime interest. For example, the sulfur ordinarily contained in JP fuels reacts with salt present in shipboard and offshore environments and the resulting compounds attack turbine buckets severely.

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PROBLEM AREA 6

Composite materials data on low cycle and thermal fatigue – Our aim here is to search for data related to composite structural materials.

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